

# Intelligent Series Gas Sensors (iseries)

Carbon Monoxide (CO) Sensor: **iCO**

Part Number: AB010-R01D-CIT

## Document Purpose

The purpose of this document is to present the performance specification of the iCO carbon monoxide gas sensor.

This document should be used in conjunction with the Product Safety Datasheet (PSDS 5). For guidance on the safe use of the sensor, please refer to the Communication Protocol (SDCS) and Sensor Mounting Application Note.



## KEY FEATURES & BENEFITS



### Digital interface

The sensor has a UART protocol to communicate with the instrument with chip select option as described in the Communication Protocol (SDCS).



### Interchangeable

All intelligent sensors have the same dimensions and communication protocol.

All sensors in the range will work with a supply voltage from 3.1 V to 3.3 V.



### Digital traceability

Sensors contain the following data: serial number, manufacturing date, and gas type for quick and easy identification of the sensor.



### OEM lock

Sensors have two levels of lock codes. The first one is an OEM specific code programmed in during manufacture and cannot be modified. This lock code is provided by the OEM. Instrument can check if the sensor has the unique code - if not the instrument can refuse the sensor. The second level of lock code is left blank and can be updated by OEM/Partners during sensor integration into the instrument as needed.



### Pre-calibrated

Sensors will be calibrated during manufacturing and calibration data is written in the sensor. Sensor will output gas concentration when interrogated by instrument.



### Predictive calibration

Sensors can predict in advance when its accuracy is becoming too poor to give a reliable, accurate reading (advanced warning of when recalibration is needed).



### End-of-life indication

Sensors can predict in advance when its sensitivity is falling too low to give a reliable, accurate reading (advanced warning for sensor replacement).



### Fault indication

Intelligent sensors can detect several internal faults like open circuit sensing/high impedance electrode, drift/fault in reference electrode, electrolyte concentration out of range, counter electrode fault; therefore notifying the user to take corrective actions.



### Designed to meet global performance standards

ATEX and IEC Ex Certified per EN IEC 60079-0 and EN IEC 60079-11

Designed to meet performance standards: BS EN 45544-1, AS/NZS 4641 and ANSI/ISA 92.00.01

RoHS 

RoHS compliant



5-year life



Compact form-fit

## TECHNICAL SPECIFICATIONS

### MEASUREMENT

<b>Operating Principle</b>	Electrochemical
<b>Target Gas</b>	CO
<b>Range</b>	0 to 1000 ppm
<b>Accuracy</b>	±5% of measuring value
<b>Filter</b>	Activated carbon cloth filter with high surface area: removes acid gases such as SO <sub>2</sub> , NO <sub>2</sub> , and H <sub>2</sub> S (up to 25,000 ppm hours H <sub>2</sub> S filter capacity); protects from exposure to alcohol such as methanol, ethanol, and IPA (up to 1,000 ppm hours)
<b>T90* Response Time</b>	<20 seconds, typ.
<b>T50* Response Time</b>	<15 seconds
<b>Output</b>	ppm output compensated for temperature
<b>Overload</b> (maximum concentration that can be reached before damaging the sensor)	2000 ppm
<b>Recovery Time from 1000 ppm to &lt;40 ppm</b>	<180 s
<b>Recovery Time from 100 ppm to &lt;2 ppm</b>	<30 s
<b>Linearity*</b>	Linear (±5% from linear up to 1000 ppm)
<b>Measurement Interval</b>	1 sample per second (1 Hz)
<b>Resolution</b>	1 ppm
<b>Baseline (Offset)*</b>	<±3 ppm
<b>Equilibrium Baseline Shift</b>	from -40°C to 60°C <±12 ppm
<b>Repeatability*</b>	±2% of measured value
<b>Orientation Sensitivity</b>	None
<b>Serial Communication</b>	UART with Chip Select

### ENVIRONMENTAL

<b>Operating Temperature Range</b>	-40°C to 60°C
<b>Operating Humidity Range</b>	5% RH to 95% RH (non-condensing)
<b>Operating Pressure Range</b>	600 mbar to 1200 mbar
<b>Recommended Storage Temperature</b>	0°C to 20°C
<b>Flow Rate</b>	Typical: 200 ml/min when using recommended gassing hood. (Consult iseries Sensor Mounting Application Note)

### LIFETIME

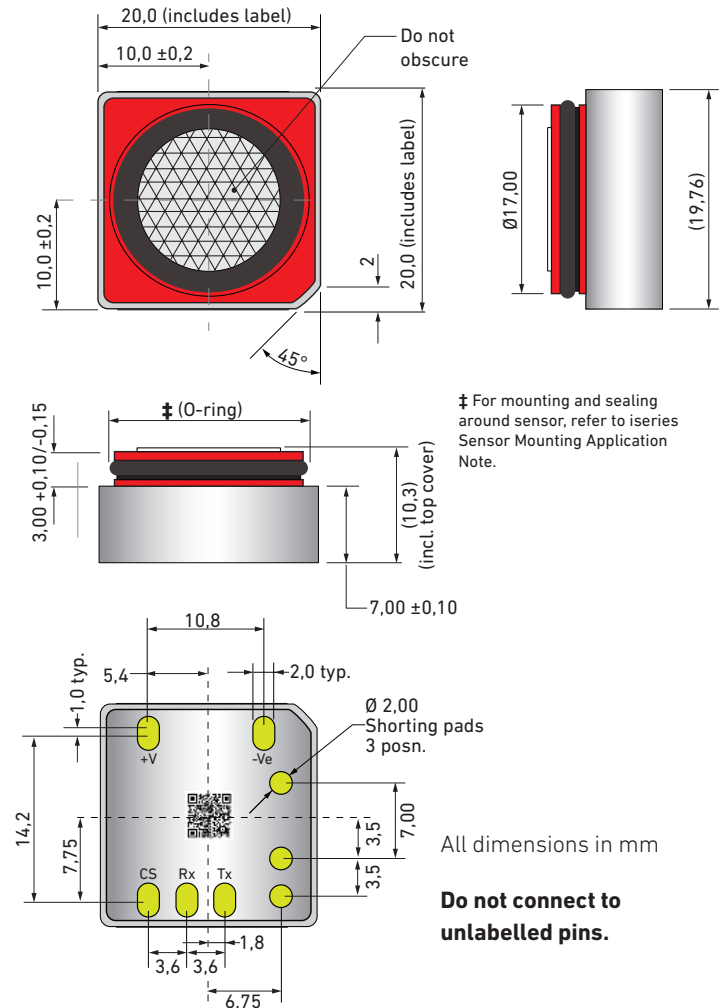
<b>Long-Term Output Drift*</b>	<5% signal loss per annum
<b>Expected Operating Life</b>	5 years in air

### PHYSICAL CHARACTERISTICS

<b>Weight</b>	<6 g
<b>Contact Material</b>	Gold plated
<b>O-Ring Material</b>	FKM60 ±5 shore A
<b>Outer Plastic Body Material</b>	Modified PPO

\* Specifications are valid at 20°C, 50% RH, and 1013 mbar using City Technology recommended circuitry. Performance characteristics outline the performance of sensors supplied within the first three months. Output signal can drift below the lower limit over time.

## Product Dimensions



All dimensions in mm

**Do not connect to unlabelled pins.**

## Electrical Specifications

	Min.	Max.	Typ.	Unit
<b>Supply Voltage (Vdd)</b>	3	3.6	3.3	Vdc
<b>Voltage of any pin relative to ground</b>	0	3.6	-	Vdc
<b>Peak supply current (typ. volt)</b>		25		mA
<b>Current: at stand-by mode</b>	-	-	15.11	µA
<b>Current: at active mode</b>	-	-	26.69	µA
<b>Average power consumption</b>	0.045	90	0.088	mW

For compatibility with the whole iseries range, the supply voltage should be between 3.1 V and 3.3 V.

## Pinout


Pin	Description
<b>+V</b>	Positive power supply
<b>-V</b>	Ground
<b>Rx</b>	Data transmitted from instrument to sensor
<b>Tx</b>	Data transmitted from sensor to instrument
<b>CS</b>	Chip Select
<b>Other Pads</b>	Do not connect, shorting link contacts only

**NOTE:** CO cells are shipped with a shorting clip which must be removed prior to installation.

## iCO Parameters

iCO parameters		Default Values	Configurable Range	Customisable: Implemented by City Technology (Non-configurable through the communication protocol)	Configurable: The parameter can be changed through the communication protocol by users	Notes
OEM Lock	OEM code (First level)	Password is customisable.* ( <b>NoLock</b> will be set by default in case the OEM lock is not required)	No more than 6 characters (ASCII format)	✓		* OEM code will be set by City Technology during sensor manufacturing. Code to be provided by OEM
	Partner code (Second level)	–	No more than 6 characters (ASCII format)		✓	Once this code has been set by user, it is not possible to change it
User Factor		User factor 0: 100 User factor 1: 96 UF 2-3: Reserved UF 4-9: Customisable ----- User factors can be added to include auto-compensation for using different membranes or instruments	10 allocated slots ----- 2 user factors are already implemented (no additional membrane and with recommended membrane), 2 are reserved and the remaining 6 can be customised	✓*	✓**	* User factor 0 and 1 programmed into the sensor during manufacturing. Additional User Factors can be added to the selectable list during the manufacturing process. This user factor has to be provided by the user. ** Users can select the desired user factor from the selectable list
Calibration	Zero (clean air)	0 ppm			✗	Calibration is performed at two points throughout the operating range of the sensor. The calibration points are defined by the zero and span values. The zero value represent the response of the sensor in clean air
	Span (target gas)	200 ppm			✓	Span is the calibration point that is done in the presence of the target gas. The span concentration can be configured through the communication protocol
Alarms	Low	35 ppm	Limit LOW lower: 15 Limit LOW upper: 2000		✓	
	High	200 ppm	Limit HIGH lower: 15 Limit HIGH upper: 2000		✓	
	STEL	100 ppm over 15 minutes	Limit STEL lower: 15 Limit STEL upper: 2000		✓	Short-Term Exposure Limit: STEL is a limit value above which exposure to a chemical substance should not occur. It usually references a 15-minute period. STEL works to prevent adverse health effects along with other unwanted effects due to peak exposure that could possibly not be controlled by the application of an 8 hour TWA limit
	TWA	35 ppm over 8 hours	Limit TWA lower: 15 Limit TWA upper: 2000		✓	Time-Weighted Average: TWA for chemical exposure can be used when each of the chemical concentration and time for exposure varies over time. It conveys the average exposure to a contaminant to which workers may be exposed without adverse effect over a period of time such as an 8-hour day or 40-hour week (an average work shift). The measurement is expressed in units of ppm
Predictive calibration	<b>The recalibration alarm will be triggered when either the countdown or the accuracy threshold are reached (whichever is triggered first).</b>					
	Countdown timer (Cal due days)	180 days			✓	The alarm will be flagged when the countdown reaches 0. The countdown restarts when the sensor is calibrated
	Accuracy threshold	±20%	±10% to ±50%		✓	The predictive calibration estimation will depend on the accuracy of the sensor (this parameter can be configured by the user). The tighter the accuracy value, the more frequent calibration needed. The sensor will request a recalibration when the default accuracy(±20% of measuring value) is reached
End of Life	<b>The EoL alarm will be triggered when either the countdown or the future prediction algorithm conditions are met</b>					
	Future prediction algorithm				✗	The algorithm triggers an alarm when the sensitivity < 50% of original sensitivity at minimum recent temperature
	Countdown timer	1825 days			✗	The countdown timer is set for 1825 days, i.e. 5 years
Deadband	Active by default	✓			✓	With the deadband enabled the sensor will read zero until the concentration exceeds the deadband value. Is normally used to prevent measurement oscillations. This function can be configured to different limits
	Incoming	8 ppm	Whole measurement range		✓	Incoming: As the reading decays down it will read zero once it has fallen below the incoming threshold
	Outgoing	10 ppm	Incoming ≤ Outgoing		✓	Outgoing: As the reading increases it will read zero until it exceeds the outgoing threshold
Bump Due Days		1 day			✓	A bump test is a brief exposure of the sensor to the target gas. The test has the objective of verifying that the sensor responds and the instrument acts accordingly. The sensor will tell the user when the bump interval has been exceeded.



Intrinsic Safety	
Entity Parameters	Ui = 5.88 V, Ii = 1.1 A, Pi = 1.2 W, Ci = 13.14 uF, Li = 0 uH
Intrinsic Safety Rating	IIC T4, ia, 60°C
ATEX Marking	 I M1 II 1G Ex ia I Ma Ex ia IIC Ga

### Poisoning

Gas sensors are designed for operation in a wide range of environments and harsh conditions. However, it is important that exposure to high concentrations of solvent vapours is avoided, both during storage, fitting into instruments, and operation. When using sensors with printed circuit boards (PCBs), degreasing agents should be used before the sensor is fitted.

Do not glue directly on or near the sensor as the solvent may cause crazing of the plastic.

Under no circumstances should intelligent sensor pads be soldered to, as this can cause leakage of electrolyte. Connection should be made via a mounting socket and spring connector.

**WARNING: SOLDERING TO PADS WILL RENDER YOUR WARRANTY VOID.**

**SAFETY NOTE**

This sensor is designed to be used in safety-critical applications. To ensure that the sensor and/or instrument in which it is used, are operating properly, it is a requirement that the function of the device is confirmed by exposure to target gas (bump check) before each use of the sensor and/or instrument. Failure to carry out such tests may jeopardize the safety of people and property.

In accordance with the company's policy of continued product improvement City Technology reserves the right to make product changes without notice. The products are always subject to a programme of improvement and testing which may result in some changes in the characteristics quoted. As the products may be used by the client in circumstances beyond the knowledge and control of City Technology, we cannot give any warranty as to the relevance of these particulars to an application. City Technology warrants goods of its manufacture as being free of defective materials and faulty workmanship during the applicable warranty period. City Technology's standard product warranty applies unless agreed to otherwise by City Technology in writing; please refer to your order acknowledgment or consult your local sales office for specific warranty details. If warranted goods are returned to City Technology during the period of coverage, City Technology will repair or replace, at its option, without charge those items that City Technology, in its sole discretion, finds defective. **The foregoing is buyer's sole remedy and is in lieu of all other warranties, expressed or implied, including those of merchantability and fitness for a particular purpose. In no event shall City Technology be liable for consequential, special, or indirect damages.** Though City Technology provides application assistance personally, or through our literature and website, it is buyer's sole responsibility to determine the suitability of the product in the application. Specifications may change without notice. The information we supply is believed to be accurate and reliable as of this writing. However, City Technology assumes no responsibility for its use.